Page 1

PATENTS

# IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s): Anthony Cyril Lowe Examiner: K. Parker

Serial No.: 09/154,019 Art Unit: 2871

Filed: September 16. 1998 Docket: 11577 (YO998-267)

For: ENHANCED LIGHT-SCATTERING Dated: March 6, 2000

DISPLAY

Assistant Commissioner for Patents Washington, DC 20231

# DECLARATION PURSUANT TO 37 C.F.R. \$1.131

Sir:

- I, Anthony C. Lowe, hereby declare that:
- 1. I am the sole applicant named in U.S. Patent Application Serial No. 09/154.019 filed September 16, 1998.
- 2. I made the invention which is disclosed and claimed in the present application, in the United States, prior to November 24, 1997, which date is the effective U.S. filing date of U.S. Patent No. 5,929,956 to Neijzen, et al.
- prior to the effective U.S. filing date of Neijzen, et al.
  annexed hereto are Exhibits A and B. Exhibits A and B consist
  of true photocopies of invention disclosures which evidence
  that the claimed invention was developed in laboratories at
  IBM Corporation in Yorktown Heights, NY prior to the November
  24, 1997 effective U.S. filing date of Neijzen, et al. The
  activity contributing to the development of the claimed
  invention was conducted by myself or by other scientists
  and/or technicians working under my direct supervision and

control prior to the effective U.S. filling date of Neijzen, et al. Dates and names have been redacted in the preparation of the photocopies contained in the attached exhibits.

- device comprising a structured solid state selectively reflective layer formed inside a display cell. said display cell comprising at least a display transducer, wherein said structured solid state selectively reflective layer transmits light that is not scattered by said display transducer and reflects a portion of light that is scattered in a forward direction by the display transducer towards a viewer. By placing the reflective layer inside the cell, improved backscattering efficiency is obtained, while eliminating parallax between the primary and reflected images
- invention disclosure which recognized that backscattering efficiency of reverse-mode polymer stabilized cholesteric structure (RM-PSCT) or any other scattering effect liquid crystal (LC) display could be improved by placing a structure, i.e., structured solid state selectivity reflective layer, inside a display device behind the LC layer which transmits light refracted through the display in its transparent state. A description of how to fabricate the claimed display device is provided in the invention disclosure as well as a figure showing the various elements of the claimed invention. Specifically, the figure in Exhibit A illustrates one possible configuration for a display cell in accordance with the present invention that contains a structured solid state selectivity reflectivity layer formed inside the display cell.

TO 917033087382

Page 3

As shown, the selectivity reflective layer is formed on a light absorbing layer that is formed on a glass substrate.

- 6. Exhibit B provides evidence of further development of the claimed invention in which it was proposed to create and then photoreproduce a white light hologram of the array rather than an actual prism.
- herein of my knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment or both under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

pared: 6 March 2000

inthony C. Lowe

JUN 14 '02 16:31 FR

TO 917033087382

P.07/14

A Commence of the commence of

coperdity the vallety of the setting.

with ESSES: The two witnesses whose dignature appear below have read and understand this entire immediate disclosure; Signature of biggress

Cere

In-sect's Signature

DISCLOSURE SUBMITTED BY

invention	n Disclosure			T 21 24 27 2	LOCATION	TEL YUK.	FOR USE BY 19L-
RILL HANES OF HAVENTONIES	VSERVO/HGDE	ENP. SER.	SIVIDEPT	10-106	Yerktown	862-3368	
thosy C Lowe	LOWELYKTVIMY	050305	RES/750A	10-100	1.6.4.6	-	
				<del> </del>		<del></del>	PATENT ATTY.
			<b></b>	<del> </del>	<del></del>	-	> ^
			<del> </del>		-		DH
				1			EVALUATOR
			├──-	<del>                                     </del>			
	<del></del>						ļ
TLE OF INVENTION (Sh	or & Descriptive)						WHERE L WHEN RECOVED
inhaneed Light-Scatte	ring Display						i
Wildlied Digit-ocute	ing Day						Ì
		•					j
	HE UNENTER SUP	(254)					•
ROBLEM SOLVED BY The backscattering efficie			is switched b	ciween a fran	sparent and a s	cattering	
						tytalau-	1
pate is improved by form les less than the critical	angle and totally into	maily reflects	s light at ang	ies larger tha	in this.		
CS ICM the second	_			• *		• *	·
			• . •			٠.	
					•	• •	
To what DISM Projes	Proposal, Gar Proc	duca, 🗆 or go	vernment conf	raci is this in	vention related?	Paper-like D	isplay
To what (JIBM Project Related and background is Keywords for dafabase scribical Dates:  ENTOR ON INTERNATI	Proposal, Gor Proposal, Gor Proposal, Gor Reference Proposal for related work:  ONAL-ASSIGNMENT.	Display, Refl	lective, Lighte	eattering, PDL	.c, PSCT	•	nt from another country?
YES, UNO. If "Yes". s	Proposal, Gor Proc publications: See Refer earch for related work: ONAL ASSIGNMENT. see instruction #5.	Display, Ref	ntor of this	eattering, PDL	this country	où ässigviwe	nt from another country?
To what DIBM Project, Related and background; Keywords for database someone of the project of th	Proposal, Gr Propublications: See Reference For related work:  ONAL ASSIGNMENT.  ee instruction #5.  ON - Provide a description of the party of the	Display, Refl	ntor of this	disclosure in	c, PSCT	a significant function	nt from another country?
To what DIBM Project, Related and background; keywords for database stribcal Dates:  TENTOR ON INTERNATION ON THE STRIP	Proposal, Gr Propublications: See Reference For related work:  ONAL ASSIGNMENT.  ee instruction #5.  ON - Provide a description of the party of the	Display, Refl	ntor of this	disclosure in	c, PSCT	a significant function	nt from another country?
To what DIBM Project Related and background; Related and background; Related and background; Related for the project of the pr	Proposal, Gr Propublications: See Reference For related work:  ONAL ASSIGNMENT.  ee instruction #5.  ON - Provide a description of the party of the	Display, Refl	ntor of this	disclosure in	c, PSCT	a significant function	nt from another country?
To what DIBM Project Related and background a keywords for database so Critical Dates.  Tentor On International Press. DNO. If "Yes", secretary of the Problem of the Problem	☐ Proposal, ☐ or Proposal, ☐ or Proposal, ☐ or Proposal, ☐ or Proposal Sea Reference of the Proposal Sea Reference of the Proposal Sea Reference of the Proposal Sea Reservation #5.	Display, Refi	nter of this and diagrams as also as the level of the level of the project of the project of the project of the project of the level of	disclosure in action of the inventor of the in	this country of the second sec	on assignme	nt from another country?
To what DIBM Project Related and background; Keywords for darabase strong on the project of the project of the problem of the problem Light scattering LC	☐ Proposal, ☐ or Proposal, ☐ or Proposal, ☐ or Proposal, ☐ or Proposal Sea Reference of the Proposal Sea Reference of the Proposal Sea Reference of the Proposal Sea Reservation #5.	Display, Refi	nter of this and diagrams as also as the level of the level of the project of the project of the project of the project of the level of	disclosure in action of the inventor of the in	this country of the second sec	on assignme	nt from another country?
To what DIBM Project Related and background; Keywords for darabase strong on the project of the project of the problem of the problem Light scattering LC	☐ Proposal, ☐ or Proposal, ☐ or Proposal, ☐ or Proposal, ☐ or Proposal Sea Reference of the Proposal Sea Reference of the Proposal Sea Reference of the Proposal Sea Reservation #5.	Display, Refi	nter of this and diagrams as also as the level of the level of the project of the project of the project of the project of the level of	disclosure in action of the inventor of the in	this country of the second sec	on assignme	nt from another country?
To what DIBM Project Related and background a keywords for darabase storium and the project of the project of the problem of the problem	☐ Proposal, ☐ or Proposal, ☐ or Proposal, ☐ or Proposal, ☐ or Proposal Sea Reference of the Proposal Sea Reference of the Proposal Sea Reference of the Proposal Sea Reservation #5.	Display, Refi	nter of this and diagrams as also as the level of the level of the project of the project of the project of the project of the level of	disclosure in action of the inventor of the in	this country of the second sec	on assignme	nt from another country?
To what DiBM Project Related and background it was background it was been contained to database so critical Dates.  ENTOR ON INTERNATIVES, DNO. If Yes", so CRIPTION OF INVENTAMENTAL Assignee Declaration The Problem  Light scattering LC ing) state.  The Invention	☐ Proposal, ☐ er Proposal, ☐ er Proposal, ☐ er Proposal, ☐ er Referient See Referient See Referient See Referient See Instruction #5.  ONAL ASSIGNMENT. ee instruction #5.  ON - Provide a description to ely a flor-coan and describe when the see Instruction with the see I	Is any invo	nter of this	disclosure in required. On or the invention.	this country.  this country.  Kingdom Ltd.	and a citiz	en of the UK.
To what Disk project Related and background; for database so critical Dates:  ENTOR ON INTERNATIONS, DNO. If "Yes", so CRIPTION OF INVENTABLE Assignee Declaration The Problem  Light scattering LC ing) state.  The Invention	☐ Proposal, ☐ er Propublications: See Refer earch for related work:  ONAL ASSIGNMENT.  ee instruction #5.  ON - Provide a description #5.  on: Anthony C Louding Anthony C Louding and describe with the control and the contro	Is any invo	nter of this and diagrams as a diagrams as a second of the level of th	disclosure in crawwed. On or the invention.	this country this country the second section of the second section of the second secon	and a citiz	nt from another country?

#### IBM Confir



### Invention Disclosure- Additional Disclosure Page

Page 2 of 3

ioto: Each Page Must Be Signed and Dated by Every Inventor and Properly Witnessed.

For IPLaw
Use only

Oisclosure Number

Attach 3 copies of any separate sketches and diagrams)

escription of Invention

cholesteric structure (RM-PSCT) or polymer dispersed liquid crystal (PDLC), to name but two. The backscattering efficiency of RM-PSCT or any other scattering effect LC display can be improved by placing a structure behind the LC layer which transmits light refracted through the display in its transparent state, for which the maximum angle of propagation is the critical angle (about 40°), but reflects light propagating through the display at angles greater than this. In a typical light scattering LC, a fraction of the light is backscattered and the remainder is forward scattered. A portion of the forward scattered light will propagate at angles greater than the critical angle.

This idea has been proposed by Kanemoto et. al., (ref 1), who placed a polymeric prism film behind a PDCL display to achieve the required effect. However, in their device the reflecting film was separated from the plane of the LC layer by more than the thickness of the cell glass and considerable parallax was observed, making the idea unsuitable for high pixel density displays.

The present invention proposes forming a structure with the required properties on the surface of the pixel electrode, avoiding the parallax problem.

The structures required are similar to those in ref 1, but with the following differences;

- I. the pitch length (and therefore the thickness) of the structure needs to be reduced to 5µm or less so that a via contact can be made through it to a TFT and the entire structure coated with ITO for optimum performance.
- 2 the structure must be all solid-state with no air gaps

The structure could also be in the form of square pyramids, rather than ridges, to achieve a symmetrical effect.

The purpose of this disclosure is to describe the idea rather than the means by which it can be reduced to practice, so the following process description is intended to be illustrative rather than definitive. All layer other than the ITO could be solvent-processable

- 1. Coat the TFT structure with a light absorbing dielectric layer
- 2. Coat this with a thin layer of transparent dielectric material of low refractive index (about 1.3)
- Deposit a layer of high refractive index (≥ 1.9) material and transform its surface into the required profile (ridges or pyramids) by photolithography and a suitable etching process.
- 4. Deposit a planarising layer of low refractive index material over the profiled surface and etch a via to the TFT drain contact

IMPORTANT: Intermedian provided by this farm may be vised to prepare a patent application which will be signed by the inversion's insurant should have great care in accurately completing the providing stall information concerning prior are. False existencess or concerning of patent will subject applicant to fine andler imprisonment (18 USC 1001) and may mis feel and the providing stall information concerning prior are. False existencess or concerning of patent will subject applicant to fine andler imprisonment (18 USC 1001) and may be visited to the assert.

journality the validity of the patent.					
WITHERSEE The two witnesses whose signature and	per below		DISCLOSURE	SUBMITTED BY	
have their and undergrand this entire interrible areas	404;	160		Inventor's Signature	
Signature of Witness	Ome				
1				1 - 4 - 5	970
		s Signalare	Cha.	Inventor's Signature	/
<b>;</b>					
		Imentor's Signature	- Quite	(prestor's Signatury	Cam
Signature of Witness	Cate			1	
				Immento Signature	Deta
		Investor & Signature	000	In-entore Signature	
1		1		1/	

92 17 47 20 **70 55** 

#### IBM Confident.

IBM Cor

# Invention Disclosure- Additional Disclosure Page

Page 3 of 3

o: Each Page Must Be Signed and Dated by Every Inventor and Property Wilnessed.	For IPLaw Use only	
tach 3 copies of any separate sketches and diagrams)		_1

For IPLSW Disclosure Number Use only

scription of invention

. 7:

5. Deposit ITO and each it into the required pixel structure

#### The Claim

- 1. A structure in close proximity to the surface of the pixel electrode in a light scattering LCD which transmits light which is not scattered and reflects a fraction of the scattered light
- 2. A structure in which all the layers are solid state
- 3. A structure comprised of ridges, pyramids, cones or other suitable shapes
- 4. A structure where the period is small compared to the pixel dimension, but sufficiently large to avoid diffraction effects
- 5. A display device in which the pixel electrode is transparent and is deposited on top of the structure
- 6. A display device in which the pixel electrode is transparent or light absorbing and is formed beneath the structure

### Implementation

Not yet

#### Potential Use

Reflective displays

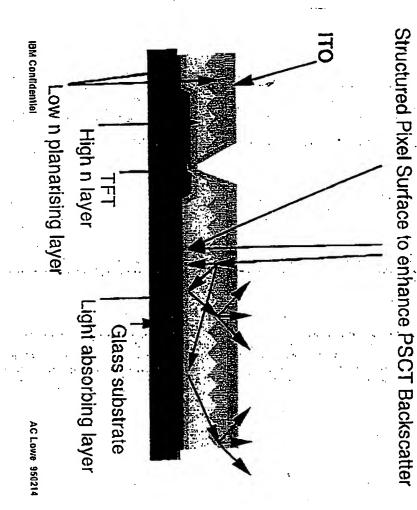
#### References

1. A Kanemoto et. al., Conference Record of the International Display Research Conference, 183, (1994).

IMPORTANT: Intermedian provided by this form may be used to present application which mill be signed by the presentable), immenters should take great tare in accurately completing in MPORTANT: Intermedian providing the intermedian concerning prior and, fishes resembled or concerning to abstining a patent will subject applicant to fine and/or imprisonment (18 USC 1001) and may a starm and in providing that intermedian concerning prior and, fishes resembled or concerning to abstining a patent will subject applicant to fine and/or imprisonment (18 USC 1001) and may

partize the solidity of the patent,							
WITH SESSES: The time witnesses where signature appear beloner to be confered and confered tale entire leading discourse;		DISCLOSURE SUBMITTED BY			0000		
Signature of Williams	Cote	i					
•		IR-nor's Signature	<del></del>	pald *	Imenter's Signature		Dec
Signments of Williams	Deta	Inventor's Signature		Care	Inventor's Signature		Dette .
· :		temper's Signature		Oris	Investor & Signature .		Deta
		·					

345-700-5(Rev. 10/51)UALOT



\*\* TOTAL PAGE.11 \*\*

JUN 14 '02 16:33 FR

TO 917033087382

P.12/14

.

.

3

.

## IBM Confidential

• •		J					
<b>国景 Invention</b>	n Disclosure					TÉL KUM.	FOR USE BY IP-
FALL HAMESTS OF DEVENTORISE	300mgmszu	EDEP, SEPR	DIVIDEPT	Bribersha	LOCATION		WE CONTROL WO
RAL MARIES OF GRANICALIST	LOWELARIAMA	050305	RES/750A	10-106	Yorktown	862-3368	
athony C Lowe	W#6/184 (			T			
	ļ	+				- t	PATENT ATTY.
		<del></del>	<del>                                     </del>	<del> </del>			
			<del> </del>				<u> </u>
					<del></del>		EVALUATOR
		_l		<u> </u>		_	
				L			
	<del> </del>			l	_		WHERE & WHEN RECEIVED
TITLE OF INVENTION (Sho Enhanced Light Scatter	ing Display (Addend		895-0070)				
PROBLEM SOLVED BY TH	IS INVENTION (Summ	ary)					
		•				,	ŀ
•			•				1

CKGROUND INFORMATION  To what UIBM Project.   Proposal,   Or Product,   Or government contract is this invention related?	Paper-like Disnlay	
Related and background publications. Twee tree Keywords for database search for related work; helgraphic helogram prism_array	•	her country?
Critical Dates: YENTOR ON INTERNATIONAL ASSIGNMENT. Is any inventor of this disclosure in this country of	on assignment item and	
YES, NO. If Yes', see instruction #5.		

Assignee Declaration: Anthony C Lowe is an employee of IBM United Kingdom Ltd and a citizen of the UK.

#### The Problem

The concept is the same as described in the original disclosure. However, rather than create the actual prism structure on the pixel electrode surface, it might prove simpler to create and then photoreproduce a white light hologram of the array:

The purpose of this addendum is to add that concept to the original disclosure.

operator the wallelity of the passed.  WITHESSES: The two witnesses whose signature represe below  the read and analytical title switch insurance disclosure;			Dette		
des last out suitables for such a manual residence of Allebers	Oso	triudest's Signorare	Çese	Invalence a Signature	Con
enature of Witness	0.00	Inversor's Signature	Siro	Inventor's Signature	Octo Octo
		In-son/a Signatur	Cate	be-embr's Signature	





# Invention Disclosure- Additional Disclosure Rage

You: Each Page Must 80 Signed and Dated by Every Inventor and Property Witnessed.

Far IPLaw Use only

Oisclosure Number

'Attach 3 copies of any separate sketches and diagrams)

Description of Invention

#### The Claim

A structure as in claim 1 of Y0895-0070 in which the layers are in the form of either a surface relief or a volume hologram. Said hologram could be produced by optical or mechanical means.

#### Implementation

Several companies are capable of producing the required holograms, but I do not believe this has been done for the present

### Potential Use

In PLDs

HTRESSES! The time unforcement wholes signature appearance made understand this action immediate distinctions	pa for-		DISCLOSURE :	SUBMITTED BY	
Signature of Witness	. 000	T <sup>·</sup>			0mo
		lishear's Signaure		lawanta/ s Signature	Own
Handley's of Williams	Onto	Inventor's Signature	Date	loreno/s Signature	Caw
	·	Section of Signature	Ogn	Imemor's Signature	Oeta

일본 영제: 80 . 10 EE로

\*\* TOTAL PAGE.14 \*\*